UNITED STATES DEPARTMENT OF AGRICULTURE
AGRICULTURAL RESEARCH ADMINISTRATION
BUREAU OF AGRICULTURAL AND INDUSTRIAL CHEMISTRY
WASHINGTON 25, D. C.

August 11, 1950

Bureau Memorandum 421

HOW TO PREPARE RESEARCH ACHIEVEMENT SHEETS

The attached leaflet is intended as an aid to all Bureau personnel concerned in the preparation of Research Achievement Sheets.

Less than half the achievement sheets on this Bureau's work submitted so far to the Washington office have been issued by the Agricultural Research Administration. Publication of the remainder has been delayed because of the unsatisfactory manner in which most of the sheets were originally prepared. Practically all those received here during the past two years have required complete rewriting to meet the standards set by the ARA Coordinator of Research Publication.

The fault hardly rests with the people in the field who are responsible for initiating achievement sheets, since they have not been given adequate instructions. It is hoped that the information supplied with this memorandum will remedy that deficiency and make clear to all concerned the nature and purpose of Research Achievement Sheets and how they should be written.

If the suggestions offered in the attachment are followed, it should be possible for us to speed up the issuance of future achievement sheets and to avoid much of the rewriting in Washington that has been necessary heretofore.

C. F. Speh

C. F. Speh
Acting Chief of Bureau

Attachment

UNITED STATES DEPARTMENT OF AGRICULTURE
Agricultural Research Administration
Bureau of Agricultural and Industrial Chemistry
Washington 25, D. C.

Attachment
Bureau Memo. 421
August 11, 1950

HOW TO PREPARE RESEARCH ACHIEVEMENT SHEETS

1. Purpose

At the back of this leaflet you will find several recent sheets on the Bureau's research. The standard heading on each of them states that the sheet was "Prepared in the public interest as a brief report of noteworthy research". In other words, the purpose of Research Achievement Sheets is to inform the general public of important USDA research accomplishments. Their function is largely historical, in a popular sense. They document USDA research for the general reader.

To do this job properly, an achievement sheet must not only explain a particular accomplishment in language that avoids being "too technical", but it should also emphasize clearly the significance of the accomplishment. How does it affect consumers, farmers, industry? What is its importance in relation to other, better known developments in the same or related fields? What implications does it have for the future? These are a few of the questions the sheet may well answer to give the general reader a better understanding of the achievement's value.

2. Readers

Research Achievement Sheets have a fairly wide distribution and many uses in the information programs of the ARA as a whole and of the Bureau. The first printing of each sheet on BAIC accomplishments is at present about 1500 copies. Two-thirds of them are distributed through the office of the ARA Coordinator of Research Publication, which maintains a selected mailing list of newspaper and magazine writers, radio agricultural directors, officers of professional associations, research groups, and industrial organizations, members of Congress, State and Federal officials, agricultural research and educational workers, and others who have a substantial interest in the work of ARA. Names are placed on this list upon request of the persons or organizations wishing to receive copies of the sheets. The remaining copies of BAIC achievement sheets are distributed by the Bureau. Since they present brief, comprehensive summaries of our research on specific problems, they are often our best means of answering requests for general information on the Bureau's work. They also meet a number of other information needs. For instance, staff members of the Research Administrator's office frequently refer to them in preparing talks or written statements for the Administrator and for other ARA or Department officials.

We may assume that readers of Research Achievement Sheets are well-educated and generally well-informed people, but we should realize that very often they will be unacquainted with the technical terminology and background of the particular accomplishment being reported. They are interested in all the essential information about a development, but this information must be presented to them in language as simple, clear, and non-technical as possible. Writers of Research Achievement Sheets should keep in mind a maxim of the journalist: Do not under-estimate your reader's intelligence; do not over-estimate his fund of information.

3. Writers

Although Bureau information personnel can and should give material assistance in the preparation of Research Achievement Sheets, best results will be obtained only if the scientific and technical personnel concerned apply themselves enthusiastically to the solution of the writing problems posed by this type of report. We might point out — to those who approach the job with undue trepidation — that all Bureau research people are in fact professional writers as well as professional chemists, engineers, etc. Their jobs continually involve writing of various kinds. Preparing technical reports is of course not quite the same thing as writing about research developments for the general reader, but the same basic qualities of clarity, simplicity, and brevity characterize good writing of both kinds.

And after all, the preparation of Research Achievement Sheets hardly demands exceptional literary talent. It does usually require not only writing but also considerable rewriting -- the boiling down, tightening up, simplifying, and clarifying of successive drafts. The emphasis needs to be right, the phrasing concrete. The writer has to know what he is trying to do. He needs enough imagination to put himself in the place of an intelligent reader who is unfamiliar with the subject under discussion. He has to determine which facts about an accomplishment are actually most important and which are less important. His view of an accomplishment cannot be confined to the laboratory or the pilot plant but must encompass also the viewpoints of consumers, manufacturers, farmers, and others concerned in the development. But all this is required not only for writing good achievement sheets — it is often required also for planning and carrying out worthwhile research and writing satisfactory technical reports about it.

4. Recognizing a "Research Achievement"

An old recipe for rabbit stew recommends, "First catch your rabbit." The first step in preparing a Research Achievement Sheet is of course to decide whether a particular achievement is suitable

for this type of report. In most cases the decision should not be hard to make. However, it may be well to offer a few suggestions for appraising accomplishments to determine whether they should be reported in achievement sheets.

The standard heading of the sheets says that they deal with "noteworthy" research. Thus the first criterion of a "research achievement" would seem to be a general agreement — within a Regional Laboratory or field station, in the first instance — that the accomplishment in question is an important contribution. As to what types of important achievements are properly reported in Research Achievement Sheets prepared by this Bureau, the suggestion of Mr. Al Kime of SRRL is a good working guide. He has proposed that major developments in the following categories merit consideration:

(1) new products or processes adopted by industry for commercial production;

(2) new products or processes that are clearly of potential value to industry;

(3) technical data developed for the control or improvement of industrial processes, either in use by commercial firms or of potential value to them; and

(4) fundamental scientific discoveries.

The decision as to the suitability of a development for reporting in a Research Achievement Sheet rests with the Laboratory Director concerned, subject to review by the Chief of Bureau and by the Research Administrator. An effort should be made to see that achievement sheets accurately reflect the Bureau's total research effort, and that they report representative accomplishments in all fields of our work.

It is emphasized that all of us in the Bureau need to be "research-achievement-sheet minded", alert to the possibility of reporting our work in achievement sheets. A Bureau unit may have a successful development that does not seem important enough for this type of report. But in looking over the field we may find that this unit or others in the Bureau have made one or more related developments. These separate contributions, taken together, may constitute a substantial research accomplishment. If so, it should be possible to prepare a single report on the work which would make an effective Research Achievement Sheet.

5. The Title

The title is usually not the first part of an achievement sheet that is written, but of course it is the first thing after the heading that the reader reads. It should catch his eye, excite

his interest, and give him a notion of what the sheet is about. The title must be fairly short, so that it will fit on one line without crowding, but it should not be a mere label. It ought to say something definite — which usually means that it needs a verb in it. This point is illustrated below, where the titles of a few recent sheets as they were originally submitted are compared with the titles finally used:

Original	Final
Establishment of a Rutin Industry	Valuable Drug from Buckwheat Is Basis for New Industry
Froth Flotation Process for Cleaning Vined Green Peas	New Froth-Flotation Process Efficiently Cleans Vined Peas
Flour for Europe from Surplus White Potatoes	Research Aids Production of Flour from Surplus Potatoes
Identification of the Volatile Constituents of Apples	Volatile Constituents of Apples Identified
A New and Practical Test for Maturity of Cotton Fibers	New Dye Test of Fiber Maturity Aids Cotton Mills

The title, then, makes a definite statement — but so does the first sentence of the body of the achievement sheet. Care should be taken to see that the title harmonizes with the opening lines of the sheet, and that undesirable repetition is avoided.

6. Main Write-Up

The essential story that a Research Achievement Sheet has to tell is presented in what we may call the "main write-up" on the front of the sheet. Here all the significant facts about a particular development and its value as a research contribution are set forth simply, vividly, and concisely. It is a page crammed full of easy-to-understand, well-ordered information. Sentences and paragraphs are short or medium in length. The write-up is organized to give proper precedence to the most important information and to clearly illuminate the subject for the reader.

7. Length of Main Write-Up

The main write-up, including the heading of the sheet, must not be longer than 2 double-spaced typewritten pages. Thus, the writer must present his story in about 500 words or less. This is why every word used must carry a maximum weight of information, why

each sentence should be carefully constructed to tell as much as possible in as little space as possible. Otherwise the write-up is likely to appear thin, rambling, and superficial.

8. Lead Paragraph

The first paragraph of the main write-up is the most important one in the sheet — and usually the most difficult to write. It should do two things: (1) tell the complete story of the research achievement in a nutshell -- that is, in two or three sentences — and (2) so interest the reader that he will continue his perusal of the sheet. Neither of these things is easy to do. For an idea of how we have tried to do them, let's look at the original and final versions of the lead paragraphs of a few recent sheets.

> NOTE: Selection of the following paragraphs does not imply adverse criticism of those who prepared the original drafts. Also, we realize that in some cases the revised paragraphs themselves could stand improvement. But we believe that the contrast between the original and final versions in each case will help to illustrate what is wanted in the lead paragraph. Copies of all published sheets referred to are attached.

(A) One of the better lead paragraphs submitted to the Washington office read as follows:

> The application of froth flotation to green-pea processing by the Department's Fruit and Vegetable Products Laboratory at Pullman, Washington, has resulted in further streamlining of this industry. The froth-flotation process makes available to pea processors a new tool which reduces the labor required to sort vined peas, increases the quality of the processed product, and permits salvage of a considerable tonnage of raw peas that would otherwise be wasted because of contamination with foreign material and debris.

The final version of this paragraph as published in R.A.S. 116 gives somewhat more information, stated perhaps a little more simply and concretely, in about the same space:

> Froth flotation, a technique first used by the mining industry for concentrating ores, has now been adapted for the commercial cleaning of vined green peas. As developed by the Bureau of Agricultural and Industrial Chemistry's Fruit and Vegetable Products Laboratory at Pullman, Wash., this process is a valuable new tool for canners and feezers of peas in the Pacific Northwest. It reduces the labor required to sort vined

peas, improves the quality of the packaged product, and saves for market large tonnages of peas that would otherwise be discarded because of heavy contamination with foreign material.

(B) The lead paragraph prepared originally for another sheet described a development that preceded the work actually reported in the sheet:

> A practical process for recovering in essence form the volatile aroma, or flavor, of fresh fruit juices has been developed by research at the Eastern Regional Research Laboratory, near Philadelphia, Pa. The essence contains all the aroma in a concentration 150 or more times that of the fresh fruit. It is a clear, water-white solution that can be kept for long periods at room temperature without alteration.

This paragraph is well written, but it simply does not summarize the achievement reported in R.A.S. 126, "Volatile Constituents of Apples Identified". Here is the lead that was used:

> The pleasing taste and aroma of apples and fresh apple juice is due mainly to volatile constituents of the fruit. Since these elusive substances vaporize easily, apple products that are cooked or pasteurized often lack the distinctive bouquet of the fruit itself. To aid manufacturers in making tastier foods from apples and to increase scientific understanding of what makes apples appetizing, the Bureau of Agricultural and Industrial Chemistry's Eastern Regional Research Laboratory in Philadelphia has made a thorough study of volatile apple constituents. Laboratory chemists succeeded in identifying at least 26 chemical compounds that help to give the apple its flavor and fragrance.

The development of ERRL's apple-essence-recovery process, which preceded the Laboratory's study of volatile constituents of apples — and which, perhaps for that reason, was mentioned first in the original version of the sheet — is dealt with in the second paragraph of the published version.

(C) Here is a final example. The following original first paragraph, although quite suitable for some purposes, needed revision in order to serve as the lead for an achievement sheet:

> The successful manufacture of cotton goods, through the stages of both mechanical and chemical processing, is influenced to a greater extent than has perhaps been generally recognized by immaturity of the fibers. Cotton that contains a significant proportion of under-developed,

> thin-walled fibers, commonly known as immature, not only often spins badly but may also show serious defects in the finished goods. This factor in the character of cotton is not indicated by ordinary classification or grading methods, and since determination of maturity by microscopic examination of individual fibers involves a complicated and time consuming technique, the industry has long needed a relatively simple and dependable mill test that would supply the desired information. Such a test has now been made available by scientists of the Department of Agriculture in the form of a widely applicable dyeing technique that is already finding extensive use.

This paragraph, though leisurely, is clear and well integrated. We felt, however, that a lead was needed which would hit the reader in the eye a little harder and summarize the development more completely in fewer words. Some of the explanatory information given in the above version could be included later in the sheet. For better or worse, here is the first paragraph that was used for R.A.S. 127:

> Using a simple dye test, cotton-mill operators and cotton dealers can now readily estimate the relative maturity of lint cotton — and thus find out in advance, more quickly than before, how the cotton is likely to behave during spinning and in other phases of processing. This useful test depends on the different reactions of mature and immature fibers to a special mixture of red and green dyes. Developed by the Southern Regional Research Laboratory of the Bureau of Agricultural and Industrial Chemistry, it is an important new contribution to better process-control methods for the cotton textile industry.

9. Body of Main Write-Up

After the first paragraph — which, as noted, should explain briefly the nature of the achievement, tell who was responsible for it, and state very generally its significance — it is usually desirable to discuss the background of the achievement and give further details concerning its nature and importance.

The organization of the main write-up following the lead will vary widely with the subject treated and with the inclinations of the writer. About all that can be recommended is that the writing be done with shorter, simpler words wherever possible, rather than with longer and more technical ones; that sentences be concise and paragraphs fairly short; and that every effort be made to use vivid, concrete expressions rather than more abstract or general terms. For instance:

Instead of —	We used —
The success achieved by physicians in the use of rutin . . .	Successful use of rutin by physicians . . . (R.A.S. 95)
pea processors	canners and freezers of peas (R.A.S. 116)
The sodium lauryl sulfate facilitates emulsification of the oil and dispersion of the air as fine bubbles	The sodium lauryl sulfate helps to emulsify the oil and aids in dispersion of the air bubbles. (R.A.S. 116)
The isoprene-styrene rubber in comparison with the GR-S rubber had somewhat higher tensile strength, better elongation, and definitely superior heat-generating characteristics.	The new synthetic is slightly stronger than GR-S rubber stretches better, and generates less heat under stress. (R.A.S. 124)
In the course of the Eastern Regional Research Laboratory's program on the industrial utilization of surplus and cull potatoes, research was underway in the Chemical Engineering and Development Division in the Fall of 1947 to convert potatoes to stable form by drying. (Original lead sentence)	The Eastern Regional Research Laboratory had already been investigating new industrial uses for surplus and cull potatoes and had studied drying methods. (First sentence of third paragraph, R.A.S. 125)
Practically no chemical work had been done on apple volatiles since the work of Power and Chestnut in 1920; and since the new process for recovering the essence was radically different from the steam distillation of the earlier workers, it was advisable to make a new examination of the product, utilizing modern techniques of identification.	Practically no chemical investigation of the volatile fractions of apple juice had been undertaken since 1920, when other research workers identified 6 volatile apple constituents. The new process now available for recovering fruit essences is radically different from the steam-distillation methods used earlier, and a complete new study of apple-flavor components, using up-to-date techniques of identification, was called for. (R.A.S. 126)

10. Signature

It is customary for the main write-up of Research Achievement Sheets to be signed, usually by the head of the Division directly

responsible for the achievement. The proper form is shown in the sheets attached. The location of the signer's laboratory is preferably not given in the signature, since it usually appears in the main write-up and will also be shown in "Reference Data".

11. Reference Data — Length

As in the case of the main write-up, "reference data" prepared for the reversed of Research Achievement Sheets must not exceed 2 double-spaced typewritten pages in length. (Typescript for a complete achievement sheet will therefore not exceed 4 double-spaced pages.)

12. Reference Data — Headings

Pertinent information is given on the reverse of each Research Achievement Sheet under the following headings:

(a) Unit responsible for achievement
(b) Persons who conducted work
(c) Date of first official announcement
(d) Selected publications
(e) Selected illustrations
(f) Estimated cost of achievement
(g) Estimated value of achievement
(h) Status and application
(i) Subappropriation(s)
(j) Fiscal year(s) in which work was done

Appropriate statements following each of these headings are virtually obligatory on all sheets. An exception is sometimes made in the case of "Selected illustrations"; however, for the majority of our achievements, some photographs or other illustrations should be available and listed.

The same care should be taken in phrasing the reference data as is recommended for the main write-up. Comments on the preparation of material to appear under each of the above headings are given below.

13. Unit responsible for achievement

The Division(s) and Regional Laboratory (or field station) and its location, along with the name of the Bureau, are usually shown. Abbreviate name of State. Cooperating organizations may be listed under this heading if their contributions were of major importance and should be recognized, or they may be shown under a separate heading (see R.A.S. 123) in whatever position on the reverse of the sheet seems most appropriate.

14. Persons who conducted work

Names are listed preferably in order of the importance of the individual's contribution to the development, or they may be listed in alphabetical order. A combination of these two methods of listing contributors may be desirable in some cases. Use of initials and last names only is preferred. If names of persons from outside agencies are given, it is usually desirable to indicate the affiliations of all persons listed.

15. Date of first official announcement

The date should be given first and the nature of the announcement (whether it was a technical paper, press release, or what, and where it was published or presented) should be indicated. If the announcement was made in a publication, appropriate reference to the publication should be made, but if it is desired to include the title, name of periodical, page reference, or similar details, these should be included under "Selected publications".

16. Selected publications

Authors of publications are not shown. References should indicate title of publication, where or in what form published, and year published. Appropriate abbreviations for names of journals may be used, but if these might not be clear to readers it is better to spell out journal names. See attached sheets for examples of proper form for this information. Only major publications on the subject should be listed. Some consideration may be given to whether the articles listed are available for distribution as reprints or in other form.

17. Selected illustrations

Subject matter and file number of appropriate illustrations should be given, along with a statement of where prints may be obtained. We should have some good photographs or other illustrations for most developments reported in Research Achievement Sheets.

18. Estimated cost of achievement

This figure is customarily based on the cost of salaries, special equipment, expenses, and supplies necessary in carrying out the work. The cost of a development may often be difficult to determine, but it is important that an effort be made to arrive at an accurate estimate.

19. Estimated value of achievement

Considerable pains should be taken to determine as accurately as possible the real or potential dollar value of the achievement. It will be a hard job in most cases and perhaps impossible in some. But the writers of achievement sheets should not give up too easily on this point. It is highly important that a concise and convincing explanation of the value of our research developments be made. A general statement of the significance and value of a particular achievement is made in the main write-up of the sheet. Information given under this heading on the reverse of the sheet should not merely repeat previous statements but should present concrete corroborative detail. (See Section 20, immediately below.)

20. Status and application

A general statement on this subject should have been made in the main write-up. Further details should be included under this reference-data heading. Contrary to the practice followed in preparing most of the attached achievement sheets, it is not necessary to designate this heading as "Status and application of achievement". The words "of achievement" are preferably omitted.

There has been a tendency for writers of Bureau Research Achievement Sheets to state for the first time under "Estimated value of achievement" or under "Status and application" certain important facts about the development reported which should have been mentioned, at least in general terms, in the main write-up. It is emphasized that information given under both these reference-data headings should be largely corroborative detail, expanding statements already made in the main write-up. However, in preparing this material for the reverse of the sheet, repetition of the phrasing used in the main write-up should be scrupulously avoided. The following examples from published sheets may help to illustrate these points:

Statement in Main Write-Up	Statement in Reference Data
Rutin strengthens weak capillary blood vessels and helps to prevent certain types of hemorrhage, and it reduces the severity and speeds the healing of X-ray burns. The industry that has sprung up to produce this drug includes 6 dehydrating plants for drying the green buckwheat and some 15 pharmaceutical concerns which extract rutin from buckwheat leaf meal. . . . As a result of the Laboratory's	Rutin has world-wide use in the treatment of hemorrhagic diseases. It may be purchased in drug stores on prescription, and large quantities are being exported to foreign countries. Fifteen manufacturers in the United States are making rutin from buckwheat leaf meal, and two of these firms have built new factories for the purpose. Six dehydrating companies are

(continued on next page)

Statement in Main Write-Up	Statement in Reference Data
work, rutin became available commercially in September 1946 and is now established as a valuable therapeutic agent.	drying buckwheat for rutin manufacture, and numerous tablet companies are preparing and marketing rutin tablets. (R.A.S. 95)
A new method for stabilizing guncotton, which saves about two-thirds of the time formerly needed for making this important explosive, has been developed . . . Because it makes possible a substantial cut in the cost of smokeless powder for large-caliber guns, the Laboratory's process can help taxpayers get more for their defense dollars . . . . Smokeless powder made with nitrocellulose stabilized by the ammonia procedure has passed all preliminary tests and is now undergoing long-term storage trials. Investigation of the powder's stability over long periods is essential . . .	This new method of nitrocellulose stabilization for wartime or peacetime use makes possible a saving of about 40 hours' time in washing and boiling each batch of smokeless powder produced. As a result, fuel costs can be markedly lowered, and much less space is required for . . . boiling tubs. . . . The successful application of the ammonia stabilization process by the Naval Powder Factory during World War II demonstrated its potentialities. . . . The continuing storage and field tests of smokeless powder made by this process will provide a final guage of its effectiveness. (R.A.S. 123)

We urge that all writers of achievement sheets study the published sheets attached -- both those from which the above examples were taken and the others at the back of this leaflet -- and observe in each case the relation of statements made in the reference data to those made in the main write-up.

21. Subappropriation

This heading is self-explanatory. Congress has recently approved a change in the Bureau's budget structure under which we will discontinue the use of subappropriation headings in budget estimates and instead use seven financial projects under one appropriations heading, "Salaries and Expenses". It will be necessary, therefore, to change the "Subappropriation" heading on Research Achievement Sheets covering Bureau work done in fiscal year 1951 and after to "Financial project(s) under which work was done".

22. Fiscal year(s) in which work was done

This heading also is self-explanatory. In some cases it may be desirable to include a statement to the effect that work on certain phases of the problem is continuing. However, an alternative and usually preferable position for such a statement is under "Status and application".

23. Other Reference-Data Headings

It is desirable in most cases to restrict the reference data of Research Achievement Sheets to information that can be presented appropriately under the ten headings mentioned above. However, exceptions to this rule can be made in special cases. Additional reference-data headings are included in two of the attached sheets. The heading "Cooperating agencies and companies" of R.A.S. 123 has already been referred to under Section 13, above. Another special heading, "Technical summary of work", was used for R.A.S. 126 on "Volatile Constituents of Apples Identified".

In the latter case it was felt that the sheet would be more widely useful and the story of the achievement better told if the highly technical information given under the special heading could be included. Permission to make this departure from the usual form was obtained from the Coordinator of Publication, ARA. In the original draft the information was presented as part of the main write-up, but since it was beyond the interest and perhaps the comprehension of many readers it could not properly be left there in the published version. However, when included in the reference data it makes a very worthwhile addition to the sheet.

It should be emphasized that special headings of this sort are in general to be avoided. They are desirable only in certain unusual cases, such as that of R.A.S. 126. In most cases, technical data on the development should be summarized and translated into language understandable to the general reader and included either in the main write-up or under reference-data headings already established.

24. Submission of Typed Drafts

Attached for your information and guidance is a sample typed draft of a typical Research Achievement Sheet. The form in which this sheet is prepared should be followed carefully in the preparation of draft sheets for submission to Washington. As noted in Section 11, above, the complete typescript should not be longer than 4 pages. A ribbon copy and two carbon copies of the draft should be submitted to the Head of the Bureau's Information Division.

25. Procedure for Handling Research Achievement Sheets

The responsibility for initiating Research Achievement Sheets rests with the Directors of the Regional Research Laboratories. Each Director may adopt whatever methods he deems most effective for the preparation of draft sheets in his Region for submission to Washington. In most cases it will probably be desirable to have the sheets reviewed by Laboratory information personnel before typing in final form. Although it is suggested that information personnel may well assist in the preparation of final drafts, research personnel having the most complete knowledge of the achievements being reported should presumably write the first drafts.

When a sheet is received in the Bureau's Washington office, it will be reviewed first by the Information Division. If it is considered satisfactory, the original and one carbon copy will be forwarded for approval to the Coordinator of Research Publication, ARA (Mr. E. G. Moore). If the original draft is not considered satisfactory by the Information Division, it may be revised in Washington or returned to the originating Laboratory for rewriting.

After review in the office of the Research Administrator, the original copy of the sheet will be returned to the Information Division, possibly with suggestions for revision. Such revisions as are requested by the Administrator's office will be made by the Information Division. If they are substantial, the revised draft will be resubmitted to the Laboratory for approval. Laboratories will also have an opportunity to check other revisions made by the Washington office if substantial changes in the original draft are involved. Final clearance of the sheet, after all ARA requirements have been met, will be by the Assistant Chief of Bureau concerned and by the Chief or Acting Chief of Bureau. The Bureau's Information Division will then have the sheet processed.

26. Distribution

The present distribution of Bureau achievement sheets is approximately as follows:

To the originating Regional Laboratory	150	copies
To Directors (10 each) and to Editors (12 each) of other Regional Laboratories	66	"
For distribution in the Washington office and to Bureau divisions in this area	20	"
Reserve supply for Washington office	245	"
For ARA mailing list (see Sec. 2, above)	869	"
Reserve supply for Administrator's office	150	"
TOTAL:	1500	copies

The above distribution may be changed at any time upon request from the Regional Laboratories or to meet the needs of the Bureau's Washington office or the ARA. The above total is the usual first printing, but the multilith plates are kept on file and additional copies of the sheets may be ordered if needed.

The copies sent to originating Laboratories may be distributed by the Laboratory in whatever manner the Director approves, subject to review by the Chief of Bureau. A check of the present ARA mailing list indicates that distribution of achievement sheets by this means is not likely to duplicate any distribution which the Bureau's Washington office or the Regional Laboratories would normally make. Besides retaining a supply of sheets for use in answering requests for information, Laboratory Directors may wish to distribute copies of the sheets originated by their Laboratories to State Agricultural Experiment Stations (certain individuals at a few stations are on the ARA mailing list), to trade, technical, or scientific journals, to local newspapers, or to individuals known to be interested in certain fields of research or in the work of the Laboratory generally.

27. A Final Word

This is a rather long statement on how to prepare Research Achievement Sheets, but we feel that a detailed discussion is warranted by the importance and difficulty of the subject. It is unlikely, of course, that this leaflet will automatically assure faultless achievement sheets, or even improved ones. Only hard work by achievement-sheet writers can accomplish that result. But the suggestions here presented do outline the standards to which the sheets should conform, and we hope they will prove helpful to all concerned.

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SAMPLE TYPESCRIPT

United States Department of Agriculture
Agricultural Research Administration

R.A.S. (C) Issued 1950

RESEARCH ACHIEVEMENT SHEET
Prepared in the public interest as a brief report of noteworthy research

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NEW DYE TEST OF FIBER MATURITY AIDS COTTON MILLS

Using a simple dye test, cotton-mill operators and cotton dealers can now readily estimate the relative maturity of lint cotton — and thus find out in advance, more quickly than before, how the cotton is likely to behave during spinning and in other phases of processing. This useful test depends on the different reactions of mature and immature fibers to a special mixture of red and green dyes. Developed by the Southern Regional Research Laboratory of the Bureau of Agricultural and Industrial Chemistry, it is an important new contribution to better process-control methods for the cotton textile industry.

It is known that immature cotton definitely hinders successful manufacture of high-grade textile products. If lint cotton contains a fairly large proportion of under-developed, thin-walled fibers — commonly known as "immature" — it often spins poorly and may cause dyeing defects in the finished goods. Ordinary methods of classifying cotton by grade and staple give little or no indication of fiber maturity. Determining maturity by microscopic examination of individual fibers — the only sure method previously known — is complicated, time consuming, and expensive. The cotton industry has long needed a simple, dependable test which would serve the purpose.

Such a test has now been devised and is in use at many mills. Work on its development began in May 1945, when a manufacturer of cotton textiles asked the Southern Regional Laboratory to help him find out why he was having trouble at his mill with uneven dyeing of raw stock and fabric. On examining the woven goods and the cotton from which they were made, the Laboratory's technologists observed a tendency toward "differential dyeing" -- it would not all dye exactly the same. Previous research had indicated that certain

differences in dyeing properties of cotton were related to the maturity or immaturity of the fibers.

It therefore seemed likely that a dye test useful to cotton mills in selecting cotton of more uniform maturity might be developed. Among the first dye combinations tried was a mixture of red and green dyes, known to be very sensitive to variations in cotton, which had already been used by one of the investigators to test yarn in mercerizing (a process used to give cotton a glossy finish). This dye mixture -- composed of "Diphenyl Fast Red" and "Chlorantine Fast Green" -- gave promising results, and experiments were continued to develop a practical test. The result is a procedure in which thick-walled or mature fibers dye red and thin-walled or immature fibers dye green when both are treated together in the red-green dye bath and then washed quickly in boiling water.

The Southern Laboratory's differential-dyeing test is so simple that it can easily be applied in an ordinary mill laboratory. Progress has been made toward its use in quantitative as well as qualitative determination of cotton maturity. The wide interest shown in this development both in the United States and abroad, and the prompt adoption of the test by leading cotton manufacturers and brokers as a dependable aid in classifying and selecting cotton for specific uses are evidence that the Laboratory has made a valuable contribution to cotton technology which should result in more economical manufacturing and production of higher quality finished goods from cotton. -- J. D. Dean, Head, Cotton Chemical Processing Division, Southern Regional Research Laboratory, Bureau of Agricultural and Industrial Chemistry.

REFERENCE DATA

R.A.S. (C)

Unit responsible for achievement: Cotton Chemical Processing Division, Southern Regional Research Laboratory, New Orleans, La., Bureau of Agricultural and Industrial Chemistry.

Persons who conducted work: C. F. Goldthwait, H. O. Smith, M. P. Barnett, E. A. Jensen, F. T. Roberts, V. C. Hasling, and L. M. Bird.

Date of first official announcement: June 3, 1947, in USDA Press Release 1218-47.

Selected publications: New Dye Technique Shows Maturity of Cotton, Textile World, 97 (7): 105-108, 201, 202, 204, 206, July 1947; Special Dyeing of Cotton on the Seed Gives Visual Evidence of Changes During First Fiber Development, Textile Res. Jour., 20 (2): 99-104, Feb. 1950; The Application of the Differential Dyeing Test for Fiber Maturity to the Processing of Cotton, Amer. Dyestuff Reporter, Feb. 6, 1950, 74-77, 90.

Selected illustrations: Sampling cotton directly from bale, SRRL Neg. 1246; Cotton entering two-color dye bath, SRRL Negs. 1249, 1449; Hot-water washing to remove excess red dye, SRRL Neg. 1451; Inspecting samples after dyeing, SRRL Neg. 1452. (Prints may be obtained from Southern Regional Research Laboratory, New Orleans 19, La.)

Estimated cost of achievement: Approximately $50,000, based on salaries, supplies, and equipment.

Estimated value of achievement: Advantages of the dye test are difficult to assess in terms of dollar values at present, but the enthusiasm with which the test has been adopted by cotton merchants and manufacturers indicates that it may eventually bring very large financial returns in the form of improved cotton-textile products. As a new processing-control method it provides a simple and quick means, previously not available, for determining the degree of cotton maturity, a factor of importance in mill operations.

Status and application: Several brokers are applying the test in their laboratories to avoid shipping unsatisfactory cotton to mills. Large cotton-textile concerns have used it for "mass dyeing", as a routine check of their regular cotton supply, to aid in selecting fiber for special purposes. One company has dyed as many as 500 samples at a time, representing separate bales, and relied on the resulting colors of the cotton to maintain the quality of their production. Excessively immature cotton is diverted into lines where it can do a minimum of harm. Several mill groups have used the method to check the blending and behavior in general of immature fibers through manufacturing processes, and it has also been used to check the uniformity of goods in cotton-finishing plants. Altogether, the Southern Laboratory has received reports indicating that more than 60 textile mills are making some application of the new cotton-maturity test. In addition, the Department of Agronomy at Louisiana State University found that the differential dyeing technique gave very accurate and consistent evaluations of fiber maturity in variety-development studies. This indicates that the test should be of practical value to cotton breeders. The Laboratory has received other reports of the test's application to special cottons, cotton linters, rayon, and other materials, which show that it is widely used for cellulosic fibers in general. Research to improve the test and to adapt it for quantitative measurements of cotton maturity is continuing.

Subappropriations: Regional Research Laboratories and Research and Marketing Act.

Fiscal years in which work was done: 1945-1949.

United States Department of Agriculture
Agricultural Research Administration

R.A.S. 95 (C) Issued July 1948

RESEARCH ACHIEVEMENT SHEET

Prepared in the public interest as a brief report of noteworthy research

VALUABLE DRUG FROM BUCKWHEAT IS BASIS FOR NEW INDUSTRY

A new drug called rutin, made from green buckwheat plants, has recently come into commercial production as a result of work by the Eastern Regional Research Laboratory, Bureau of Agricultural and Industrial Chemistry. Rutin strengthens weak capillary blood vessels and helps to prevent certain types of hemorrhage, and it reduces the severity and speeds the healing of X-ray burns. The industry that has sprung up to produce this drug includes 6 dehydrating plants for drying the green buckwheat and some 15 pharmaceutical concerns which extract rutin from buckwheat leaf meal.

Although rutin was discovered in 1842, in the plant known as garden rue, its beneficial properties were not realized, and for a hundred years it remained a laboratory curiosity. Other discoveries, however, finally brought rutin to the attention of medical science. In 1936, the Hungarian chemist Szent-Györgyi found a substance in citrus extracts which restored weakened capillaries and remedied various hemorrhagic conditions. He tentatively named this substance "vitamin P". Biochemists in many countries have since tried unsuccessfully to isolate and identify this vitamin.

In January 1942, while studying the minor chemical constituents of tobacco plants, Dr. James F. Couch of the Eastern Regional Research Laboratory isolated rutin from flue-cured tobacco. The chemical structure and pharmacological properties of this substance (designated as a flavonol glucoside) suggested to Dr. Couch that it might be the long-sought vitamin P, or at least that it might have the same effect in restoring human capillaries to normal. He arranged for tests of rutin by Drs. John Q. Griffith, Jr., and M. A. Lindauer of the University of Pennsylvania Medical School, who were experienced in the medicinal use of vitamin P extracts.

After testing the drug for two years, the doctors had enough evidence to show that rutin restores weakened capillary walls to normal in 85 percent of the cases. Continued use by the medical profession has demonstrated the drug's effectiveness in treating a wide variety of hemorrhagic conditions, including purpura, idiopathic bleeding, retinal hemorrhage, and frostbite, and in lessening the severity of bleeding in hemophilia. The fact that rutin affords substantial protection against the harmful effects of X-rays indicates that it may benefit persons exposed to dangerous atomic radiation.

Successful use of rutin by physicians led to a demand for large quantities of the drug. Since it could not be procured elsewhere, the Eastern Regional Laboratory undertook in June 1944 to prepare the rutin needed for clinical studies. High-grade tobacco was much too expensive a raw material, and various plants known to contain rutin were analyzed in the search for a more economical source. The plant finally selected was green buckwheat, which not only is cheaper than flue-cured tobacco but contains 8 to 12 times as much rutin.

Many problems had to be solved before practical ways for producing rutin from buckwheat were developed. The Laboratory determined the best time for harvesting the green plant, the conditions for drying to minimize losses of rutin, the varieties of buckwheat best adapted for rutin production, and processes for extracting and refining the drug. As a result of the Laboratory's work, rutin became available commercially in September 1946 and is now established as a valuable therapeutic agent. -- James F. Couch, *in charge, Tobacco Section, Analytical and Physical Chemistry Division, Eastern Regional Research Laboratory,* Bureau of Agricultural and Industrial Chemistry.

For reference data, see other side

REFERENCE DATA

R.A.S. 95 (C)

Unit responsible for achievement: Eastern Regional Research Laboratory, Bureau of Agricultural and Industrial Chemistry.

Persons who conducted work: The pioneer research work was done by James F. Couch, with the collaboration of M. J. Copley, C. F. Krewson, J. Naghski, W. L. Porter, and B. A. Brice. Chemical engineering phases were conducted by Roderick K. Eskew, G. W. Macpherson Phillips, Paul W. Edwards, Edward L. Griffin, Jr., Nicholas C. Aceto, and Alfred Shaines. Pharmacological investigations were conducted by F. DeEds, R. H. Wilson, A. M. Ambrose, T. G. Mortarroti, and E. K. Doxtader.

Date of first official announcement: May 1944 (see first reference under selected publications).

Selected publications: Effect of Rutin on Increased Capillary Fragility in Man, Soc. Expt. Biol. Med. Proc. 55: 228-9, 1944; Rutin, AIC-52 (processed), 1944; Buckwheat as a Source of Rutin, Science 103: 197-8, 1946; The Chemistry and Therapeutic Use of Rutin, AIC-115, 1946; Production of Rutin from Buckwheat Leaf Meal, AIC-114, 1946; Extraction and Refining of Rutin from Green Buckwheat, AIC-160, 1947.

Selected illustrations: Photographs of equipment used in pilot-plant production of rutin and of the growing and harvesting of buckwheat, and an exhibit panel illustrating the extraction of buckwheat to produce rutin, are available at the Eastern Regional Research Laboratory, Philadelphia 18, Pa.

Estimated cost of achievement: Approximately $300,000 for salaries and expenses.

Estimated value to the public: It is expected that eventually 50,000 acres will be required to produce buckwheat for rutin manufacture, and the income to farmers from this acreage should total at least $2,000,000 per year. If the entire crop is converted to leaf meal at $250 per ton, the dehydrators should receive more than $9,000,000 and the rutin produced should have a value of approximately $150,000,000. But rutin's greatest value is in the alleviation of human suffering, which cannot be measured in monetary terms.

Status and application: Rutin has a world-wide use in the treatment of hemorrhagic diseases. It may be purchased in drug stores on prescription, and large quantities are being exported to foreign countries. Fifteen manufacturers in the United States are making rutin from buckwheat leaf meal, and two of these firms have built new factories for the purpose. Six dehydrating companies are drying buckwheat for rutin manufacture, and numerous tablet companies are preparing and marketing rutin tablets.

Current Subappropriation: Regional Research Laboratories.

Current Financial project: Eastern Regional Research Laboratory.

Fiscal years in which work was done: 1943-48, inclusive.

United States Department of Agriculture
Agricultural Research Administration

R.A.S. 110 (C)

Issued October 1948

RESEARCH ACHIEVEMENT SHEET

Prepared in the public interest as a brief report of noteworthy research

WHITE STARCH MADE FROM SWEETPOTATOES BY NEW PROCESS

Scientists and engineers have been working for 20 years on the problems of growing and processing sweetpotatoes for starch. Although various difficulties remain, particularly those involved in sweetpotato production, chemists of the Department of Agriculture have devised a practical way to make white starch from sweetpotatoes.

Before the 1930's, sweetpotato starch was not manufactured commercially in the United States, chiefly because known methods left the product with an undesirable yellow color. In 1931, however, scientists of the Bureau of Agricultural and Industrial Chemistry (then the Bureau of Chemistry and Soils) originated a method for removing this color. The process was adapted for commercial production, and from 1934 to 1945 it was used in a factory at Laurel, Miss., operated by sweetpotato growers and supported by the Emergency Relief Administration. From 1945 to 1947 the process was employed in a considerably larger starch plant at Clewiston, Fla.

The Bureau researchers who first developed a method for making white sweetpotato starch were R. T. Balch and H. S. Paine. Another chemist in the Bureau, F.H. Thurber, modified their process for industrial use and directed construction of the Laurel factory. Production methods and starch quality were steadily improved by Bureau technologists during the 11 years of operations at Laurel. The process as finally perfected used lime water for initial purification of the starch, followed by bleaching with sodium hypochlorite.

The improved sweetpotato starch is superior for some uses to cornstarch and other cereal starches and also to certain imported root starches. When used in sizing warp yarns for cotton textiles, it results in stronger yarn and smoother fabrics. Its transparency makes it particularly suitable for finishing dyed goods.

Sweetpotato-starch manufacture has great potential importance for southern agriculture. Besides giving the country a domestic source of root starch, most of which now comes from cassava imported from the Tropics, it would provide a valuable new market for a widely grown southern crop. Because of these possibilities, horticulturists and engineers are continuing research to lower the cost of growing and harvesting sweetpotatoes for starch.--P. R. Dawson, *Head, Sweetpotato Products Division, Southern Regional Research Laboratory*, Bureau of Agricultural and Industrial Chemistry.

For reference data, see other side

REFERENCE DATA

R.A.S. 110 (C)

Unit responsible for achievement: Bureau of Agricultural and Industrial Chemistry.

Persons who conducted work: R. T. Balch, H. S. Paine, F. H. Thurber, P. R. Dawson. Other workers on project: R. M. Kingsbury, H. H. Hall, O. W. Bissett, P. W. Bohne, D. M. Batson, F. A. Crenshaw, G. L. Doremus, W. O. Gordon, L. H. Greathouse, E.A. Gastrock, J.T. Hogan, H. J. Janssen, T. A. McLemore, and N. Porges.

Date of first official announcement: November 1931 (see first reference below).

Selected publications: Production of Starch from Sweetpotatoes, Indus. & Engin. Chem. 23: 1205-1213, 1931; Chemical and Physical Properties of Sweetpotato Starch, Indus. & Engin. Chem. 25: 565-568, 1933; Improved Method for Production of Sweetpotato Starch, Indus. & Engin. Chem. 25: 919-920, 1933; Sweetpotato Starch, a New Farm Industry for the South, Mfrs. Rec. 106: 40-41, 1937; Manufacturing of Sweetpotato Starch in the United States, Indus. & Engin. Chem. 30: 1334-1348, 1938; Starch Production in the Florida Everglades, South. Power & Indus. 64 (6): 44-47, 98, 1946.

Selected illustrations: Control laboratory, Laurel starch plant, SRRL Neg. 204; Screening system used in sweetpotato-starch pilot plant, SRRL Neg. 996; Purification of sweetpotato starch by high-speed centrifuging, SRRL Neg. 997. Photographs are available at Southern Regional Research Laboratory, 2100 Robert E. Lee Boulevard, New Orleans 19, La.

Estimated cost of achievement: Approximately $500,000, representing salaries and expenses chargeable to the initial research and to continued investigations to improve the manufacturing processes and equipment and the quality and value of the products.

Estimated value of achievement: A new industry has been made possible by this research. During the 11 years of operation of the starch factory at Laurel, Miss., nearly 11 million pounds of starch and more than 4½ million pounds of byproduct feed were marketed, providing a new outlet for more than a million bushels of sweetpotatoes from local farms.

Status and application of achievement: The Laurel factory was set up in 1934 and operated through 1945 on an essentially commercial basis. Its capacity reached 30 to 40 thousand pounds of starch a day, mostly from sweetpotatoes grown locally for starch production. The factory also provided an outlet for culls and other sweetpotatoes normally unmarketable. From 1945 to 1947 the process was used at a large commercial factory at Clewiston, Fla., operated by the United States Sugar Corporation. This plant had a capacity of 240 thousand pounds of starch a day. Suspension of this enterprise in 1947 was due primarily to the high cost of growing sweetpotatoes with the practices and equipment so far developed. This is the principal limiting factor in the commercial production of sweetpotato starch, and research is being undertaken in the Bureau of Plant Industry, Soils, and Agricultural Engineering and at the State experiment stations to reduce sweetpotato production costs.

Subappropriation: Regional Research Laboratories. (Prior to 1941, work was carried on under Agricultural Chemical Investigations.)

Fiscal years in which work was done: 1930-46.

United States Department of Agriculture
Agricultural Research Administration

R.A.S. 116(C)

Issued January 1949

RESEARCH ACHIEVEMENT SHEET

Prepared in the public interest as a brief report of noteworthy research

NEW FROTH-FLOTATION PROCESS EFFICIENTLY CLEANS VINED PEAS

Froth flotation, a technique first used by the mining industry for concentrating ores, has now been adapted for the commercial cleaning of vined green peas. As developed by the Bureau of Agricultural and Industrial Chemistry's Fruit and Vegetable Products Laboratory at Pullman, Wash., this process is a valuable new tool for canners and freezers of peas in the Pacific Northwest. It reduces the labor required to sort vined peas, improves the quality of the packaged product, and saves for market large tonnages of peas that would otherwise be discarded because of heavy contamination with foreign material.

The Laboratory's method solves several problems that have long troubled green-pea processors and makes possible further streamlining of the industry. From planting to packaging, most of the industry's operations are highly mechanized. The only step that requires extensive hand labor is inspection of prepared peas before canning or freezing. Various special processes are used to minimize this hand work, including mechanical separation of peas and foreign substances on a basis of size and density, air cleaning, and washing. But these measures are not completely effective, and if the raw peas contain large amounts of foreign matter, it means a great deal of work for the inspectors. Also, conventional methods do not satisfactorily remove cracked peas and pea skins or eliminate nightshade berries and tar-weed seeds. These berries and seeds are a particularly serious problem in the pea fields of the Northwest. Hand cleaning the peas contaminated with them is impractical, and formerly whole lots often had to be thrown out.

With the froth-flotation process, however, sound peas can be separated efficiently from nightshade berries and other contaminating materials, including skins and cracked peas. The process depends upon differences in "wettability" between peas and foreign matter when they are passed through tanks containing a special chemical solution. Tiny air bubbles, dispersed through the solution by a circulating pump, provide a froth that helps to float out the contaminating substances.

The wetting properties of the water used in the process are controlled by adding sodium lauryl sulfate to the solution. This causes sound peas to become wet more easily than nightshade berries and other contaminants. Wettability differences are further increased by putting a small amount of light mineral oil into the solution. The sodium lauryl sulfate helps to emulsify the oil and aids in dispersion of the air bubbles. In this solution, the easily wetted peas sink readily. Foreign substances, wetted less easily, are buoyed up by the frothy bubbles and float to the surface of the solution where they can be separated.

Suitable equipment for operating the froth-flotation process on a commercial scale was developed at the Fruit and Vegetable Products Laboratory in Pullman, and a regulator was devised that automatically controls the wetting properties of the solution used. In 1947, commercial pea processors in the area near Walla Walla, Wash., constructed and operated 14 froth-flotation units representing a combined cleaning capacity of 34 tons of shelled peas an hour. One food-equipment company began manufacturing froth-flotation units, and during 1948 there were 23 units in operation with a total cleaning capacity of 65 tons of peas per hour. More than three times this capacity will probably be required to meet the needs of the entire pea-processing industry.--A. M. Neubert, *In Charge, Fruit and Vegetable Products Laboratory*, Pullman, Wash., Bureau of Agricultural and Industrial Chemistry.

For reference data, see other side

REFERENCE DATA

R.A.S. 116 (C)

Unit responsible for achievement: U.S. Fruit and Vegetable Products Laboratory, Pullman, Wash., Bureau of Agricultural and Industrial Chemistry.

Persons who conducted work: A. M. Neubert and M. K. Veldhuis.

Date of first public announcement: April 1944, in USDA Press Release No. 2152-44, A New Method for Cleaning Canned Peas.

Selected publications: Cleaning Vined Canning Peas by Froth Flotation -- Removal of Nightshade, West. Canner and Packer 36(6): 18, 19, 47, May 1944; Cleaning Vined Canning Peas by Froth Flotation, Food Indus. 17(5): 494-497, 608, 610, 612, 614, 616, May 1945; Using Froth Flotation to Clean Vined Canning Peas, Food Indus. 19(6): 769-772, 890, 892, June 1947.

Other announcements: At meeting of Northwest Canners Assoc., Gearhart, Oreg., Jan. 9, 1946; and at Canners and Frozen Food Packers School, Oregon State College, Corvallis, Oreg., Feb. 7, 1947.

Estimated cost of achievement: About $21,000 over a period of six years, including time and expenses involved in consultation with processors on application of the process.

Estimated value of achievement: $600,000 (at present) to $2,000,000 (potential value) annually. The process makes possible a direct saving of about three-fourths of the labor involved in hand sorting small-sieve peas, and at the same time it improves the quality of the peas by more complete removal of splits and skins than is possible by hand. In addition, large quantities of peas in the Walla Walla district that would otherwise have been discarded because of infestation with nightshade or other weeds, were salvaged for processing. Packers have estimated that 3 to 10 percent of their 1941 crop was rejected because of nightshade-berry contamination. Since then, the problem has become more severe, and according to some packers it would now present a serious threat to the industry in this area if there were not some means of control or removal of the berries. Processors in the area now pack about 6 million cases of canned peas a year, as well as a considerable portion of the Nation's supply of frozen peas. The potential over-all value of the flotation process in the Walla Walla area, when the froth-flotation process is fully exploited, is estimated at $1,000,000 annually, with perhaps twice this amount saved each year when the process reaches maximum usage throughout the green-pea-processing industry.

Status and application of achievement: About two-thirds of the pea-processing plants in the Walla Walla area are using the process. Total froth-flotation cleaning capacity of these plants is about 65 tons of peas per hour. It is estimated that froth-flotation units with a capacity of 200 to 300 tons per hour could be used effectively to serve the industry in all parts of the country.

Subappropriation: Agricultural Chemical Investigations.

Financial project under which work was done: Fruit, Vegetable and Other Agricultural Products of the West: Investigations of the Chemistry, Technology, Processing and Utilization for Foods and for Feeds, Including the Utilization and/or Disposal of Food Factory Wastes.

Fiscal years in which funds were used: 1942-48.

United States Department of Agriculture
Agricultural Research Administration

R.A.S. 123 (C)

Issued October 1949

RESEARCH ACHIEVEMENT SHEET

Prepared in the public interest as a brief report of noteworthy research

NEW PROCESS FOR STABILIZING GUNCOTTON AIDS NATIONAL DEFENSE

A new method of stabilizing guncotton, which saves about two-thirds of the time formerly needed for making this important explosive, has been developed by the Southern Regional Research Laboratory of the Bureau of Agricultural and Industrial Chemistry. Because it makes possible a substantial cut in the cost of smokeless powder for large-caliber guns, the laboratory's process can help taxpayers get more for their defense dollars. The new method also permits powder factories to be smaller and thus less vulnerable to air attack in the event of war, as well as easier to move underground if necessary.

Guncotton, or nitrocellulose, is the main ingredient of smokeless powder, the propellent explosive used in firing shells from big artillery rifles and naval guns. It is made by treating cellulose -- usually cotton linters, the short fibers left on cottonseed after ordinary ginning -- with a mixture of nitric and sulfuric acids. The nitric acid combines chemically with the cellulose, transforming it into guncotton. The sulfuric acid, which acts as a sort of catalyst in the process, must later be washed and boiled out. Even small amounts of this acid left in the finished nitrocellulose make it unstable, or likely to decompose. This instability may result in a gradual loss of the guncotton's explosive power or a change in its rate of power release. Under certain conditions, incompletely purified nitrocellulose may explode prematurely. Removing all traces of the sulfuric acid is difficult, and the conventional procedure for purifying and stabilizing the explosive is long, laborious, and expensive.

The new procedure, devised by Richard E. Reeves and coworkers at the Bureau's New Orleans laboratory, takes much less time and requires much smaller operating space and less fuel than the conventional process. It removes most of the sulfuric acid by washing and boiling, as in the usual method, but in one-third to one-fourth the usual time -- that is, in 20 hours instead of the customary 60 to 80 hours. All remaining traces of acid are then neutralized quickly with ammonia, a procedure which makes further boiling of the guncotton unnecessary. This final step of the new process may be carried out either at ordinary or at elevated temperatures.

Development of the new stabilizing method was a result of research undertaken by the laboratory during the war to find out whether staple cotton cut to short lengths could be used in smokeless powder to supplement the limited U. S. supply of cotton linters. Laboratory chemists nitrated the cut cotton fibers to see if they were suitable as guncotton (which they were) and incidentally hit upon the new method of stabilizing nitrocellulose. Their findings were immediately made available to the armed forces. The process was applied successfully in a large-scale test run by the Naval Powder Factory at Indian Head, Md., in 1944.

Smokeless powder made with nitrocellulose stabilized by the ammonia procedure has passed all preliminary tests and is now undergoing long-term storage trials. Investigation of the powder's stability over long periods is essential to make certain that nitrocellulose prepared by this method will perform, when needed, exactly in accordance with previous ballistic determinations. -- Kyle Ward, Jr., *Head, Cotton Fiber Research Division*, Southern Regional Research Laboratory, Bureau of Agricultural and Industrial Chemistry.

For reference data, see other side

REFERENCE DATA

R.A.S. 123 (C)

Unit responsible for achievement: Southern Regional Research Laboratory, Bureau of Agricultural and Industrial Chemistry, New Orleans, La.

Persons who conducted work: Richard E. Reeves, Joel E.Gliddens, Julius R.Jung, Jr., J. David Reid, Kyle Ward, Jr., and D. F. J. Lynch.

Date of first official announcement: July 30, 1946, date of issuance of U.S. Patent No. 2,404,887, Stabilization of nitrocellulose. U. S. Patent No. 2,471,583 issued May 31, 1949.

Selected Publications: Stabilization of cellulose nitrate with ammonia, Indus. Engin.Chem. 39:1303-1306, 1947; Mechanism of ammonia stabilization of cellulose nitrate, Indus. Engin. Chem. 39:1306-1309, 1947.

Estimated cost of achievement: Approximately $50,000 representing salaries, material and expenses chargeable to the research. This does not include the cost of related studies on the nitration of cut cotton fiber.

Estimated value of achievement: This new method of nitrocellulose stabilization for wartime or peacetime use makes possible a saving of about 40 hours time in washing and boiling each batch of smokeless powder produced. As a result, fuel costs can be markedly lowered, and much less space is required for the necessary boiling tubs. Besides the peacetime economic advantages of the quicker method and more compact plant, reducing the size of powder factories is particularly important in wartime. Large, sprawling establishments naturally make good targets for air attack, and the biggest, most vulnerable part of a conventional powder factory is the boiling house. Making this unit smaller, as is possible when using the new process, also simplifies relocation of the plant underground or converting it to production of other products.

Cooperating agencies and companies: Naval Powder Factory, Indian Head, Md., Radford Ordnance Works, Radford, Va.; Hercules Powder Company, Wilmington, Del.; and Western Cartridge Company, Alton, Ill.

Status and application of achievement: The successful application of the ammonia stabilization process by the Naval Powder Factory during World War II demonstrated its potentialities. Two commercial producers of smokeless powder also cooperated with the Southern Regional Research Laboratory in tests of the process during the war. They demonstrated the feasibility of the new method on a laboratory scale, and results of their evaluation of guncotton produced in this way by the Naval Powder Factory indicated that the process was suitable for large-scale operations. The continuing storage and field tests of smokeless powder made by this process will provide a final gauge of its effectiveness.

Subappropriation: Regional Research Laboratories.

Fiscal years in which work was done: 1942-47.

United States Department of Agriculture
Agricultural Research Administration

R.A.S. 124 (C)

Issued December 1949

RESEARCH ACHIEVEMENT SHEET

Prepared in the public interest as a brief report of noteworthy research

SYNTHETIC RUBBER PRODUCED FROM TURPENTINE

A new type of high-quality synthetic rubber, made with a chemical derived from turpentine, has been developed by scientists of the Bureau of Agricultural and Industrial Chemistry. This achievement, a result of work begun during the war by the Bureau's Naval Stores Research Division, makes it possible to use turpentine as a supplementary source of synthetic rubber in a national emergency. Under present conditions rubber from turpentine is somewhat more costly than GR-S, the most common synthetic rubber now produced commercially. But the new synthetic, compounded for use in tires, is slightly stronger than GR-S rubber, stretches better, and generates less heat under stress.

Main ingredient of the new elastomer is isoprene, a compound that forms the basic molecular unit of natural rubber. It is obtained from turpentine by a special molecule-splitting process developed by Bureau researchers. Isoprene produced from petroleum is already used in some types of synthetic rubber now on the market. The Bureau's method of producing it from turpentine should be a valuable national asset in the event of emergency shortages of petroleum.

First step in synthesizing rubber from turpentine is to produce isoprene from the turpentine's hydrocarbon constituents, called terpenes. Each molecule of isoprene has 5 atoms of carbon and 8 atoms of hydrogen. Terpene molecules are made of exactly twice this number of atoms -- 10 of carbon and 16 of hydrogen. Scientists of the Naval Stores Research Division devised a process for splitting the terpene molecule in half to obtain two molecules of isoprene.

This is done by immersing a conductor of high-resistance iron wire, heated red hot by an electric current, in boiling turpentine. The liquid vaporizes around this conductor and is heated to about 1400° F. When terpene molecules in the vapor strike the wire at this temperature they are split in two. The split molecules -- isoprene -- immediately bounce off into the liquid turpentine, which cools them sufficiently (even though it is boiling) to prevent further decomposition.

A continuous, two-stage distillation process removes the newly formed isoprene molecules from the turpentine bath and keeps them from again touching the red-hot wire. A water-cooled condenser first liquefies some of the vapors from the bath to unchanged turpentine, which is returned for further treatment. The remaining vapors, containing the isoprene, pass to a second condenser where they are liquefied with solid carbon dioxide ("dry ice"). This procedure gives a 70-percent yield of isoprene that is about 95-percent pure. It is made 99-percent pure by redistillation.

In producing synthetic rubber, the purified isoprene (either alone or in combination with styrene, a compound used also in GR-S rubber) is mixed with water, soap, a catalyst, and a modifier, and shaken for a specified time at a warm temperature. One formula, found to yield approximately 80 percent of high-quality synthetic rubber suitable for use in tires, calls for 75 parts (by weight) of isoprene, 25 parts styrene, 180 parts water, 5 parts soap, 3/10 part potassium persulfate (as a catalyst for the copolymerization of the isoprene and styrene), and 2/10 part mercaptan (which regulates the polymerizing action). This mixture is shaken for 14 hours at a temperature of about 120° F. The resulting synthetic rubber has a tensile strength of about 3,800 pounds per square inch, will stretch to 7 times its length, and in standard tests develops 7 to 18 degrees (F.) less heat under stress than similarly produced and compounded GR-S rubber. -- E. L. Patton, *Head, Naval Stores Research Division*, Bureau of Agricultural and Industrial Chemistry.

For reference data, see other side

REFERENCE DATA

R.A.S. 124 (C)

Unit responsible for achievement: Naval Stores Research Division, New Orleans, La., Bureau of Agricultural and Industrial Chemistry.

Persons who conducted work: S. Palkin, L. A. Goldblatt, R. V. Lawrence, A. J. Johanson, F. L. McKennon, B. L. Davis, Dorothy M. Oldroyd, Elsie T. Field, Barbara E. Hillery.

Date of first official announcement: September 10, 1946, at High Polymer Forum, American Chemical Society, Chicago, Ill. (production of rubber). Production of isoprene from turpentine announced April 12, 1943, before Division of Organic Chemistry, American Chemical Society, Detroit, Mich.

Selected publications: Production of Isoprene from Turpentine Derivatives, Indus. Engin. Chem. 38: 53-57, 1946; Emulsion Copolymerization of Isoprene and Styrene, Indus. Engin. Chem. 40: 2086-2090, 1948.

Selected illustrations: Apparatus for pyrolysis of terpenes to isoprene, SRRL Neg. 1523; Apparatus for purification of isoprene by distillation, SRRL Neg. 1524; Equipment for weighing isoprene into polymerization bottles, SRRL Neg. 1519; Interior of constant temperature bath showing method of attaching polymerization bottles, SRRL Neg. 1520; Alternate method of carrying out the isoprene-styrene polymerization, SRRL Neg. 1521; Samples of rubber obtained from isoprene-styrene polymerization, SRRL Neg. 1522. (Prints may be obtained from Southern Regional Research Laboratory, New Orleans 19, La.)

Estimated cost of achievement: $45,000, representing salaries and expenses over a period of 5 years.

Estimated value of achievement: Although this discovery has not yet been of direct monetary value, isoprene-styrene synthetic rubber for use in tires and other rubber articles and the process for obtaining isoprene from turpentine are of great potential importance in the event of a national emergency.

Status and application of achievement: A method is available for the production of isoprene in good yield from turpentine, and for the production of high-quality synthetic rubber from isoprene. Economic considerations now make it impractical to manufacture this rubber except under emergency conditions. Isoprene from turpentine must compete with that produced from petroleum. Although the isoprene obtained from petroleum is more difficult to purify to the degree required than is isoprene from turpentine, the former is nevertheless more economical at present, because its raw-material costs are relatively low. Isoprene-styrene synthetic rubber is also more expensive than butadiene-styrene rubber (GR-S), and so far its superiority to the latter product has not been found great enough to warrant the added cost of production. However, the development of isoprene-styrene rubber and the process for obtaining isoprene from turpentine remain important contributions to the nation's emergency rubber-producing facilities.

Subappropriation: Naval Stores Investigations.

Fiscal years in which work was done: 1943-1948

United States Department of Agriculture
Agricultural Research Administration

R.A.S. 125 (C)

Issued January 1950

RESEARCH ACHIEVEMENT SHEET

Prepared in the public interest as a brief report of noteworthy research

RESEARCH AIDS PRODUCTION OF FLOUR FROM SURPLUS POTATOES

Faced with critical food shortages in Europe and with a potato surplus at home, the United States in 1948-49 undertook a program for converting large quantities of American potatoes to flour for shipment abroad. The program required a vast increase in the country's potato-flour production, and this was achieved in part by using idle distillery equipment to make the flour. Methods for putting this equipment to work and overcoming the technical difficulties involved were developed by technologists at the Bureau of Agricultural and Industrial Chemistry's Eastern Regional Research Laboratory in Philadelphia.

Normal domestic output of potato flour is about 15 million pounds a year. Regular plants operating at maximum capacity could produce approximately twice this amount. The potato-flour program, however, called for production at 20 times the normal rate. Double-drum driers and steam-tube driers, available at many distilleries, offered a means of rapidly expanding production facilities. But these driers were designed to produce distillery feed byproducts, and methods had to be devised for using them satisfactorily to make potato flour.

The Eastern Regional Research Laboratory had already been investigating new industrial uses for surplus and cull potatoes and had studied drying methods. When the need arose to adapt distillery drying equipment to potato-flour production, chemical engineers at the Laboratory immediately began pilot-plant tests of double-drum driers for making the flour. Their main problem was finding out how to cook and whip the potatoes so they would adhere properly to the surfaces of the drums in the drying process. The successful results of this work were published in June 1948. The Laboratory soon received numerous requests from distilleries asking help in starting potato-flour production. Laboratory workers aided many of these plants individually to make best use of their equipment.

The Laboratory then developed on a pilot-plant scale an entirely new process for making potato flour using steam-tube driers. This method was found to give a satisfactory product at about half the cost of potato flour produced by conventional means. It involved washing the unpeeled whole potatoes, grinding them in a hammer mill, and treating them with sulfur dioxide to prevent them from turning dark. They were then dried in the steam-tube drier, run through a second hammer mill, screened, and bagged as flour and meal. The most serious difficulty in this process -- sticking of the ground potatoes in the drier tubes -- was overcome by "recycling" a portion of the dried product, i.e., mixing it with the freshly ground potatoes to reduce their moisture content. Results of this work, including cost estimates and all necessary data for plant operation, were published in November 1948.

About 350 million pounds of potato flour, produced by more than 60 companies, was shipped to Europe under the potato-flour program. The methods developed at the Eastern Regional Research Laboratory, used by many of the producing plants, contributed substantially to the success of this effort to relieve hunger abroad and to convert many of the country's surplus potatoes to worthwhile food use.-- Roderick K. Eskew, *Head, Chemical Engineering and Development Division*, Eastern Regional Research Laboratory, Bureau of Agricultural and Industrial Chemistry.

For reference data, see other side

REFERENCE DATA

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Unit responsible for achievement: Eastern Regional Research Laboratory, Philadelphia 18, Pa., Bureau of Agricultural and Industrial Chemistry.

Persons who conducted work: Albert Hoersch, Jr., Nicholas C. Aceto, Joseph B. Claffey, and Miles J. Willard, Jr., under the direction of Paul W. Edwards, in charge of the Potato Products Development Section, and Roderick K. Eskew, head of the Chemical Engineering and Development Division.

Date of first official announcement: June 1948 (see first title under "Selected publications)".

Other announcements: July 16, 1948, in USDA Press Release 1467-48, U. S. Increases Production of Flour from Surplus Potatoes; and December 9, 1948, in USDA Press Release 2567-48, Low-Cost Potato Flour May Help Expand Markets for Surplus Potatoes.

Selected Publications: Utilization of Idle Equipment in Distilleries for Production of While Potato Flour, AIC-190, June 1948; Producing Feed and Flour from White Potatoes with Steam Tube Driers, AIC-209, November 1948; Conversion of Potatoes to Stable Form, Amer. Potato Jour., May 1949.

Estimated cost of development: $30,000, covering salaries and expenses.

Estimated Value of achievement: The direct monetary value of these processes cannot be estimated. Their value lies in their having contributed notably to the solution of the surplus-potato problem and to the utilization of idle equipment to produce food for a hungry Europe.

Status of achievement and its application: Extensive pilot-plant studies have yielded basic engineering data for the design and operation of large-scale plants using the processes. This information has been widely disseminated through publications and through direct contact with potential manufacturers. Many plants have employed the processes in large-scale production.

Subappropriation: Regional Research Laboratories.

Fiscal years in which work was done: 1947-48.

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VOLATILE CONSTITUENTS OF APPLES IDENTIFIED

The pleasing taste and aroma of apples and fresh apple juice is due mainly to volatile constituents of the fruit. Since these elusive substances vaporize easily, apple products that are cooked or pasteurized often lack the distinctive bouquet of the fruit itself. To aid manufacturers in making tastier foods from apples and to increase scientific understanding of what makes apples appetizing, the Bureau of Agricultural and Industrial Chemistry's Eastern Regional Research Laboratory in Philadelphia has made a thorough study of volatile apple constituents. Laboratory chemists succeeded in identifying at least 26 chemical compounds that help to give the apple its flavor and fragrance.

This work began in 1946, after the Laboratory had developed a new method for recovering and concentrating volatile apple "essence", which can be used to improve the flavor of apple products. (See R. A. S. 85(C), November 1947.) The process is adapted also to production of grape-juice essence and to recovery of volatile constituents of other fruits. It is now employed commercially. Fundamental research by the Laboratory to identify volatile apple constituents has provided basic information necessary for developing more effective apple-processing methods and better procedures for using apple essence in food products.

Prior to the Laboratory's study, practically no chemical investigation of the volatile fractions of apple juice had been undertaken since 1920, when other research workers identified 6 volatile apple constituents. The new process now available for recovering fruit essences is radically different from the steam-distillation methods used earlier, and a complete new study of apple-flavor components, using up-to-date techniques of identification, was called for.

It turned out to be a formidable job. The 26 substances identified occur in almost infinitesimal amounts. (Major components are listed on the reverse of this sheet.) All of them together constitute only 50 parts per million of the fresh juice, or less than one-tenth of 1 percent (0.075%) of the 150-fold essence concentrate prepared for the study. In some cases new techniques for separating the constituents had to be developed. Several of the compounds identified (for instance, 2-hexenal) are so rare that they had to be synthesized to provide the researchers with necessary reference material. Efforts to produce a synthetic apple essence using a mixture of the major ingredients were not successful, and it appears unlikely that synthetic essences will replace the natural fruit-flavor concentrates.

The results obtained in this investigation provide needed fundamental knowledge of apple flavors, which is expected to prove of great value both to basic research and to the apple-processing industry. Methods developed for the study of volatile constituents of apples are applicable also to investigations of other farm products.
--J. J. Willaman, *Head, Biochemical Division*, Eastern Regional Research Laboratory, Bureau of Agricultural and Industrial Chemistry.

For reference data, see other side

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Technical summary of work: The principal volatile components identified, by classes, and the relative quantities of each class present, are:

Alcohols (92%) -- methanol, ethanol, n-propanol, isopropanol, n-butanol, isobutanol, d-2-methylbutanol, and n-hexanol;

Carbonyl compounds (6%) -- acetaldehyde, acetone, n-caproaldehyde, and 2-hexenal; Esters (2%) -- ethyl butyrate and ethyl caproate. (Methanol, ethanol, isopropanol, and n-butanol, and formic, acetic, propionic, butyric, and n-caproic acids were identified as components of other esters.)

Preliminary separation of these constituents was accomplished by high-precision, high-efficiency fractional distillation. Final separation of the various components was made almost exclusively by chromatographic methods, and this required the development of new techniques for separating aldehyde and alcohol derivatives in small quantities. The carbonyl compounds were separated chromatographically as 2,4-dinitrophenylhydrazones; the free alcohols and those from esters were converted to their 3,5-dinitrobenzoates and separated in fluorescent chromatographic columns; organic acids from esters were separated by partition chromatography and identified by X-ray diffraction of the anilides. Roughly quantitative data only were obtained for most of the compounds. An outstanding accomplishment of this work was the separation in small quantities of adjacent normal aliphatic alcohols, from methyl through hexyl.

Unit responsible for achievement: Eastern Regional Research Laboratory, Bureau of Agricultural and Industrial Chemistry.

Persons who conducted work: J. W. White, Jr., with E. C. Dryden, W. P. Ratchford, F. R. Senti, and L. P. Witnauer.

Date of first official announcement: January 22-23, 1947, at a conference of apple-juice manufacturers at the Eastern Regional Research Laboratory.

Selected publications: Chromatographic Separation of Aliphatic 2,4-Dinitrophenylhydrazones, Anal. Chem. 20: 726, August 1948; Separation of Aliphatic Alcohols by Chromatographic Adsorption of Their 3,5-Dinitrobenzoates, Anal. Chem. 20: 853, September 1948; Cptically Active 2-Methylbutyl 3,5-Dinitrobenzoates, Jour. Amer. Chem. Soc. 71: 1136, March 1949; and Composition of a Volatile Apple Concentrate, Jour. Amer. Chem. Soc. (in press).

Estimated cost of achievement: $30,000.

Estimated value of achievement: No direct monetary value can be assigned. Results of this study of volatile apple constituents, which was undertaken at the request of flavoring-extract manufacturers, have helped in the improvement of the quality and methods of production of apple essence, and will make possible more effective use of the essence in food products. The work has also pointed the way to similar studies of the Laboratory with other farm products.

Status and application of achievement: More than 100 requests for reprints of articles on this work have been received, indicating that the Laboratory's techniques are probably being used by chemists of numerous other organizations. Study of volatile apple constituents has opened the way for investigations of the volatile fractions of other fruits and of vegetables, tobacco, silage, and forage crops. The methods developed are now being applied at the Eastern Laboratory in research on fermented tobacco, and they will be used also for other fruit and vegetable research.

Subappropriation: Regional Research Laboratories.

Fiscal years in which work was done: 1946-48.

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RESEARCH ACHIEVEMENT SHEET

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NEW DYE TEST OF FIBER MATURITY AIDS COTTON MILLS

Using a simple dye test, cotton-mill operators and cotton dealers can now readily estimate the relative maturity of lint cotton -- and thus find out in advance, more quickly than before, how the cotton is likely to behave during spinning and in other phases of processing. This useful test depends on the different reactions of mature and immature fibers to a special mixture of red and green dyes. Developed by the Southern Regional Research Laboratory of the Bureau of Agricultural and Industrial Chemistry, it is an important new contribution to better process-control methods for the cotton textile industry.

It is known that immature cotton definitely hinders successful manufacture of high-grade textile products. If lint cotton contains a fairly large proportion of under-developed, thin-walled fibers--commonly known as "immature"--it often spins poorly and may cause dyeing defects in the finished goods. Ordinary methods of classifying cotton by grade and staple give little or no indication of fiber maturity. Determining maturity by microscopic examination of individual fibers--the only sure method previously known--is complicated, time consuming, and expensive. The cotton industry has long needed a simple, dependable test which would serve the purpose.

Such a test has now been devised and is in use at many mills. Work on its development began in May 1945, when a manufacturer of cotton textiles asked the Southern Regional Laboratory to help him find out why he was having trouble at his mill with uneven dyeing of raw stock and fabric. On examining the woven goods and the cotton from which they were made, the laboratory's technologists observed a tendency toward "differential dyeing" -- it would not all dye exactly the same. Previous research had indicated that certain differences in dyeing properties of cotton were related to the maturity or immaturity of the fibers.

It therefore seemed likely that a dye test useful to cotton mills in selecting cotton of more uniform maturity might be developed. Among the first dye combinations tried was a mixture of red and green dyes, known to be very sensitive to variations in cotton, which had already been used by one of the investigators to test yarn in mercerizing (a process used to give cotton a glossy finish). This dye mixture -- composed of "Diphenyl Fast Red" and "Chlorantine Fast Green" -- gave promising results, and experiments were continued to develop a practical test. The result is a procedure in which thick-walled or mature fibers dye red and thin-walled or immature fibers dye green when both are treated together in the red-green dye bath and then washed quickly in boiling water.

The Southern Laboratory's differential-dyeing test is so simple that it can easily be applied in an ordinary mill laboratory. Progress has been made toward its use in quantitative as well as qualitative determination of cotton maturity. The wide interest shown in this development both in the United States and abroad, and the prompt adoption of the test by leading cotton manufacturers and brokers as a dependable aid in classifying and selecting cotton for specific uses are evidence that the Laboratory has made a valuable contribution to cotton technology which should result in more economical manufacturing and production of higher quality finished goods from cotton. -- J. D. Dean, *Head, Cotton Chemical Processing Division*, Southern Regional Research Laboratory, Bureau of Agricultural and Industrial Chemistry.

For reference data, see other side

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Unit responsible for achievement: Cotton Chemical Processing Division, Southern Regional Research Laboratory, New Orleans, La., Bureau of Agricultural and Industrial Chemistry.

Persons who conducted work: C. F. Goldthwait, H. O. Smith, M. P. Barnett, E. A. Jensen, F. T. Roberts, V. C. Hasling, and L. M. Bird.

Date of first official announcement: June 3, 1947, in USDA Press Release 1218-47.

Selected publications: New Dye Technique Shows Maturity of Cotton, Textile World 97 (7): 105-108, 201-202, 204, 206, July 1947; Special Dyeing of Cotton on the Seed Gives Visual Evidence of Changes During Fiber Development, Textile Res. Jour. (In press); The Application of the Differential Dyeing Test for Fiber Maturity to the Processing of Cotton. Amer. Dyestuff Reporter (In press).

Selected illustrations: Sampling cotton directly from bale, SRRL Neg. 1246; Cotton entering two-color dye bath, SRRL Negs. 1249, 1449; Hot-water washing to remove excess red dye, SRRL Neg. 1451; Inspecting samples after dyeing, SRRL Neg. 1452. (Prints may be obtained from Southern Regional Research Laboratory, New Orleans 19, La.)

Estimated cost of achievement: Approximately $50,000, based on salaries, supplies, and equipment.

Estimated value of achievement: Advantages of the dye test are difficult to assess in terms of dollar values at present, but the enthusiasm with which the test has been adopted by cotton merchants and manufacturers indicates that it may eventually bring very large financial returns in the form of improved cotton-textile products. As a new processing-control method it provides a simple and quick means, previously not available, for determining the degree of cotton maturity, a factor of importance in mill operations.

Status and application of achievement: Several brokers are applying the test in their laboratories to avoid shipping unsatisfactory cotton to mills. Large cotton-textile concerns have used it for "mass dyeing" as a routine check of their regular cotton supply, to aid in selecting fiber for special purposes. One company has dyed as many as 500 samples at a time, representing separate bales, and relied on the resulting colors of the cotton to maintain the quality of their production. Excessively immature cotton is diverted into lines where it can do a minimum of harm. Several mill groups have used the method to check the blending and behavior in general of immature fibers through manufacturing processes, and it has also been used to check the uniformity of goods in cotton-finishing plants. Altogether, the Southern Laboratory has received reports indicating that more than 60 textile mills are making some application of the new cotton-maturity test. In addition, the Department of Agronomy at Louisiana State University found that the differential dyeing technique gave very accurate and consistent evaluations of fiber maturity in variety-development studies. This indicates that the test should be of practical value to cotton breeders. The Laboratory has received other reports of the test's application to special cottons, cotton linters, rayon, and other materials, which show that it is widely used for cellulosic fibers in general. Research to improve the test and to adapt it for quantitative measurements of cotton maturity is continuing.

Subappropriations: Regional Research Laboratories and Research and Marketing Act.

Fiscal years in which work was done: 1945-1949.